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ABSTRACT

This paper reviews and synthesizes information on the administrative aspects of technology implementation in special education, based on the findings of eight federally funded projects sponsored by the Division of Innovation and Development of the Office of Special Education Programs. Three of the projects specifically focused on administrative aspects, while the remaining five projects studied implementation or integration of technology in general, including both administrative and instructional aspects. Characteristics of successful projects are categorized as follows: (1) providing administrative leadership; (2) promoting communication and collaboration; (3) providing personnel and technology resources; and (4) providing training and support for teachers. Successful research strategies are outlined. Summary descriptions of the individual projects are also provided. Projects included: Microcomputers in the Schools--Implementation in Special Education (SRA Technologies and Cosmos Corporation); National Assistance Project for Special Education Technology (The NETWORK, Inc.); Administrative Applications of Technology (American Speech-Language-Hearing Association); Studies of Special Education Administrative Involvement in Computer Implementation (Macro International); Technology Integration Project--Elementary Level (Johns Hopkins University); Evaluation of the Integration of Technology for Instructing Handicapped Children--Middle School Level (Education Development Center); Model for the Integration of Technology for Instructing Handicapped Students--High School Level (Macro International); and Making Administrative Decisions about Technology by Examining Promising Instructional Practices (Macro International). (JDD)

Administrative Aspects of Technology Implementation in Special Education

A Synthesis of Information from Eight Federally-Funded Projects

Prepared by the Division of Innovation and Development
Office of Special Education Programs
Office of Special Education and Rehabilitative Services
United States Department of Education

May, 1992

This paper is a review and synthesis of information on the administrative aspects of technology implementation in special education based on the findings of eight federally-funded projects. These projects are listed on page 6. The numbers in the first column of this list are used to identify the projects in the following discussion. Summary descriptions of individual projects can be found in the tables beginning on page 7.

The eight projects were funded by the Division of Innovation and Development to study the use of technology in special education. Three of the projects (3, 4, 8) specifically focused on administrative aspects; while the remaining five projects (1, 2, 5, 6, 7) studied implementation or integration of technology in general, including both administrative and instructional aspects.

The projects used a variety of research methods. The most common approach (used by all of the projects) was to apply qualitative methods with multiple data sources such as interviews, observations, and document analysis. Projects also used correlation or multiple regression (4, 7), single subject (5), quasiexperimental (5), and survey (3, 4) methods.

The following discussion of effective administrative practices was based on an analysis of concurring findings across the projects reviewed. It should be noted that some of the findings were supported by data that were not fully conclusive, and that additional research is needed to support and refine the findings.

Effective Administrative Practices for Implementing Technology in Special Education

All of the projects reported that administrative involvement was important for the successful implementation of technology in special education. Findings across the projects suggested a number of effective administrative practices. These practices can be categorized as follows:

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1. Providing Administrative Leadership
2. Promoting Communication and Collaboration
3. Providing Personnel and Technology Resources
4. Providing Training and Support for Teachers

Findings in each of these categories are discussed below.

1. Providing Administrative Leadership

Patterns of Mixed Centralization and Decentralization. One key issue relating to administrative leadership was the degree of centralization or decentralization, i.e. the amount of centralized administrative control over technology implementation. Several projects found patterns of mixed centralization and decentralization. Control of instructional applications tended to be decentralized, with teachers determining their own patterns of use, selecting their own software, managing their own software collections, and sometimes managing hardware (5, 7). Special education administrators tended to be more involved in hardware and software acquisition (4, 7). At the school level, principals were reported as making decisions at the building level, while teachers had control at the classroom level (5). Decentralization and centralization both had apparent benefits, and a balance between the two seemed to be an appropriate goal.

The Benefits of Decentralization. Decentralization of instructional control was reported as resulting in great variability in type and extent of CAI use (7). Several projects found value in this decentralization and the flexibility it allowed, advising administrators to encourage rather than force the use of technology, to give teachers choices, to encourage innovation and creativity, and to vary expectations on the basis of teachers' needs, interests, and abilities (1, 3, 4, 6, 8).

The Benefits of Centralization. Centralization appeared necessary for certain leadership functions to occur. One project observed that for successful technology integration to occur beyond individual classrooms, administrators needed to have a vision of the value and potential of computers and to understand that integration implied instructional and organizational changes (6). Several other projects suggested leadership functions, such as communicating support and commitment, identifying implementation models, setting goals, and integrating technology on the basis of a strong and effective curriculum (2, 3, 4, 6, 8).

Several projects found that centralization was important in ensuring the availability of resources. One project supported the hypothesis that administrator involvement increased the availability of resources and supports which ultimately lead to increased use of computers by special education students (4).

Plan for a Long-Term, Developmental Process. The process of technology implementation was found to be prolonged and marked by different implementation

needs at different stages. For example, one project noted that technology implementation tended to begin as a "bottom-up" process, but that more centralized and formalized roles and arrangements eventually developed (1). Another project noted that factors such as a district's current level of use (degree of integration and staff comfort with computers) and readiness (i.e. administrative support, staff and monetary resources) determined appropriate implementation goals and strategies at each stage (2). This project also noted that development and implementation of a practice often required two school years, and that actual institutionalization of a new practice rarely occurred in that period of time.

2. Promoting Communication and Collaboration

Between Special Education and Regular Education. Special education and regular education often shared computer resources at the school level (1, 4), and ongoing communication between regular and special educators who taught the same students was reported to facilitate technology integration (6). Establishing communication links between regular and special education on technology issues was reported as an effective practice (1, 6, 8).

Between Administrators and Teachers. One study reported that two types of skills and authority--administrative control and recent or current instructional experience--seemed to be needed when technology was implemented (1). Other projects supported the involvement of staff members in planning and implementing programs or training (3). One project reported that once a technology-related decision was made, administrators and teachers needed to communicate directly to determine if the decision was working or needed revision (6).

In Committees and Groups. One project found that direct interactions between teachers and administrators were infrequent, but occurred most often in committee settings (4). Another project noted a trend from informal "users groups" to established computer committees (7). Projects supported the involvement of committees and other groups in technology implementation (3, 7). In fact, one project required districts to assemble local planning teams including special and regular education staff, teachers and administrators, and others as a condition for receiving technical assistance (2).

Between Teachers. One project reported that teachers tended to collaborate regarding software selection, acquisition, and organization of computers (5). Another reported that when two people collaborated to try out software, technology use tended to be more successful (6). Fostering such communication was a recommended practice (8).

3. Providing Personnel and Technology Resources

Personnel Resources. One project reported that administrators often contributed to technology implementation by "handpicking" key staff (8). Another project recommended assigning responsibility to an individual on site (4). Another project reported that someone needed to be responsible for maintaining hardware, and that someone needed to be responsible for seeing that technology-related decisions were implemented (6).

Technology Resources. Not surprisingly, the projects found that access to technology was a highly significant factor in technology implementation. The nature of the access and technology were found to be important. For example, projects found that technology acquisition, allocation and use should be appropriate to current level of technology use, identified technology needs, curriculum goals, and teacher experience and expertise (2, 3, 6).

4. Providing Training and Support for Teachers

Training. Teacher training was found to be important in technology implementation (1, 3, 4, 5, 6, 8). The projects identified a number of factors that contributed to teacher participation in training and to the presumed effectiveness of training. Among these were the following:

- Controlled introduction of content to avoid overwhelming staff and to allow teachers time to acquire and integrate knowledge about students, technology, curriculum, instruction, and assessment (3, 6).
- Teacher reflection with others about their instructional use of technology (6).
- Training in the use of teacher-modifiable software to increase the use of CAI and increase curriculum correspondence (5).
- Relevance of training, and teacher participation in planning of training (8).

Support and Assistance. Technical assistance or support for teachers was also identified as critical, both as a follow-up to training and as an independent procedure (1, 3, 4, 6, 7, 8). One project reported that during the early stages of technology implementation, teacher assistance was more critical than training (1). Another project reported that on-the-spot technical assistance accounted for a good deal of staff development (8). Assistance providers included technology or computer coordinators (1, 8), support groups (3, 8), and other teachers (3, 5, 6, 7, 8).

Research Strategies

The Use of Qualitative Methods

The extensive use of qualitative methods in these projects can be attributed to aspects of the research topic such as the following.

Holistic. There were numerous interrelated variables that could not be meaningfully studied in isolation. Variables associated with administrators, teachers, hardware and software, policies, classroom practice, etc. all acted and interacted in various and complex ways.

Exploratory. The researchers had to expect the unexpected. Because relatively little was known about the processes of integration or implementation of technology in special education, designs were needed that could deal with unexpected findings in a systematic way.

Difficult to Quantify. Many important factors were difficult to quantify and measure. For example, teacher perceptions, aspects of the school culture, shifts in organizational structures, etc. were best dealt with using qualitative methods.

Successful Research Strategies

The projects reviewed for this paper faced a significant challenge in conducting research on a broad and complex topic with limited time and resources. Projects had the greatest apparent success in addressing this challenge when they met the following conditions:

- Interpretations and conclusions were realistic and parsimonious in view of the available data, i.e. data were not stretched "too thin."
- Complete descriptions were provided of settings, methods, findings and analysis procedures, allowing the reader to follow the chain of evidence from data to conclusions, and to interpret the conclusions appropriately.
- Appropriate and rigorous analysis techniques were employed.
- Materials and approaches to implementation were firmly based on research.
- Implementation recommendations were tested and revised on the basis of field-based try outs, giving adequate attention to the implementation process as well as the desired outcomes.

Project List

Project Number	Project Name and Institution	Page
(1)	Microcomputers in the Schools--Implementation in Special Education. SRA Technologies, Inc. and Cosmos Corporation.	7
(2)	The National Assistance Project for Special Education Technology. The NETWORK, Inc.	10
(3)	The Administrative Applications of Technology. American Speech-Language-Hearing Association.	15
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(5)	Technology Integration Project (Elementary Level). Johns Hopkins University.	20
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(8)	Making Administrative Decisions about Technology by Examining Promising Instructional Practices. Macro International, Inc.	33

(1) Microcomputers in the Schools--Implementation in Special Education	
INSTITUTION	SRA Technologies, Inc. and Cosmos Corporation
PERIOD OF PERFORMANCE	1982 - 1984
PROJECT DIRECTOR(S) AND PRINCIPAL INVESTIGATOR(S)	Tom V. Hanley and Robert K. Yin
FEDERAL PROJECT OFFICER(S)	Jane Hauser
CONTRACT NUMBER	300-82-0250
DOCUMENTS REVIEWED FOR THIS PAPER	Microcomputers in the Schools--Implementation in Special Education: Case Study Report (1983); Microcomputers in Special Education: Organizational Issues (1983); <u>MICROSPED Information Bulletin</u> , Issues 1-10 (1984)
FOR FURTHER INFORMATION	Refer to ERIC Documents ED 254 006; ED 238 222; ED 238 221. Contact Tom Hanley at OSEP/OSERS, U.S. Department of Education, 400 Maryland Ave. S.W., Washington DC 20202-2641. Telephone: (202) 205-8110.
CONTENT AND BACKGROUND	This project studied microcomputer implementation in special education.
RESEARCH METHODS	RESEARCH FINDINGS
Case studies were conducted of 12 school districts, which were selected on the basis of geographic dispersion, elementary and secondary programs, administrative and instructional applications, instructional applications with students representing a variety of handicapping conditions, history of implementation at least one-and-one-half years prior to the study, and varying patterns of collaboration between special and regular educators in the use of computers. The focus was on "microcomputer systems", defined as a set of microcomputers shared by an identifiable group of users and characterized by shared resources and decision making.	<u>Initial Adoption</u> * Initial adoption tended to be "bottom-up" rather than "top-down", often initiated by a small group of teachers operating in relative isolation from the central administration. * Collaborative planning between regular and special education during initial adoption was <u>not</u> a requirement for subsequent collaboration. <u>Later Collaborative Patterns</u> * Following initial adoption of microcomputers, there was extensive collaboration between regular and special education in purchasing and allocating

Data were collected during site visits in accordance with a case study protocol.	hardware, managing use, training staff, and selecting and using software. • The high degree of collaboration between special and regular education tended to be greatest at the school level. • There was no strong differentiation between special education and regular education use of microcomputers. Identical or similar hardware and software were used, inservice training was similar, and computer resources were often shared. • However, special education use of microcomputers emphasized CAI, while regular education use emphasized computer literacy and programming, but also included CAI. • There were some specialized special education applications such as IEP systems, communication aides, and adapted computer devices.
	<u>Supervising Microcomputers-Top Down or Bottom Up?</u> • No pattern of centralization or decentralization dominated. Most school systems contained both centralized and decentralized decision-making patterns. • Patterns shifted over time--key personnel shifted their roles, teachers became recognized computer coordinators. • Neither centralized nor decentralized patterns were clearly superior. Both had potential advantages and pitfalls. • A more important factor seemed to be the presence of persons with key skills and authority: recent or current teaching experience and administrative control. Persons with these skills can work as a formal or informal team.
	<u>Administrative vs Instructional Applications</u> • The growth of microcomputer systems tended to be strongest where administrative and instructional applications were mixed.

	<u>Training and Emerging Staff Roles</u> * Availability of training was associated with utilization of microcomputers. * During the early start-up phase, training was not a critical factor. Early users tended to be self-taught, and individual technical assistance appeared to be more important at this phase. * As implementation became more widespread, training became a more efficient way to reach a larger number of teachers. * The relevance of training was critical for teacher participation. * Training for special educators was similar to training for regular educators. * In each of the school districts, one or more persons were identified to plan and manage microcomputers. In most cases, school districts established "coordinator" positions which tended to be school based.
DISSEMINATION/IMPLEMENTATION STRATEGIES	DISSEMINATION/IMPLEMENTATION OUTCOMES
A series of ten monthly reports summarizing principal research findings were issued during 1984. One of these reports listed the following major elements of effective implementation: 1 Acquire microcomputers on an incremental basis. 2 Appoint a microcomputer coordinator. 3 Formalize staff and user training. 4 Involve both administrators and teachers in the implementation process. 5 Make microcomputer applications work early; start with simple approaches. 6 Expand microcomputer uses to include administrative as well as instructional applications. 7 Define and nurture a microcomputer "system."	

(2) The National Assistance Project for Special Education Technology	
INSTITUTION	The NETWORK, Inc.
PERIOD OF PERFORMANCE	1983 - 1986
PROJECT DIRECTOR(S) AND PRINCIPAL INVESTIGATOR(S)	Michael Mayo
FEDERAL PROJECT OFFICER(S)	Jane Hauser
CONTRACT NUMBER	300-83-0258
DOCUMENTS REVIEWED FOR THIS PAPER	Final Report: Part I (Project Description); Part II (Evaluation); and Part III (Case Studies and Vignettes) (1986)
FOR FURTHER INFORMATION	Contact Michael Mayo, The Network, Inc., 300 Brickstone Square, Suite 900, Andover, MA 01810. Telephone: (508) 470-1080.
CONTENT AND BACKGROUND	This project provided technical assistance to local school district personnel as they implemented technology within special education programs. The general approach was based on previous research on external change agents and school improvement, and attempted to combine dissemination with development of local capacity for problem solving. Previous research findings included: the significance of person-to-person assistance, the need for sustained assistance over time, the importance of faculty involvement and administrator support, and the essential role of internal leadership.
RESEARCH METHODS	RESEARCH FINDINGS
Specific technical assistance approaches included: individualized planning assistance, information services, training and demonstrations, linking and networking, and consulting with national experts.	During the first year, pilot testing in three LEAs indicated that attention to processes and long-range goals needed to be tempered with understanding of the LEAs' more immediate and content-oriented concerns.
Key implementation features included Local Co-Coordination, Local Planning Teams, and Cooperative Assistance Agreements.	During the three-year course of the project, technical assistance was provided to over fifty special education programs around the country.

Seven in-depth case studies and six "mini-cases" were conducted using exploratory case study and qualitative data analysis methodologies. Data were gathered using questionnaires, interviews, and observations. Types of outcomes addressed included: 1 development/implementation of new practices 2 institutionalization of new practices 3 institutionalization of ongoing process to address issues of special education technology	
<u>Main research questions:</u> 1 The impact of site condition variables on project outcomes	The site-specific variables found to have the greatest impact on the outcomes of technical assistance were: 1 The level of the district's use of technology in special education prior to the intervention (the degree computers were integrated into instructional and administrative practices, and the degree teachers and administrators were comfortable with their use) 2 The district's readiness to make change * administrative support * amount of staff time to work on project * access to monetary resources in district 3 The nature of the local planning team, including * the team's knowledge and skill re technology * the team's interest and skill re planning for change * the level of team commitment to the process of technology implementation 4 The quality of team leadership--ability to coordinate a team effort 5 The organizational context

2 The impact of particular technical assistance strategies (goals and activities) on project outcomes	Five categories of goals emerged: 1 Training--planning team or district wide training on technology or planning for change 2 Implementation of new practices--instructional or administrative 3 Development of management systems--software acquisition and distribution, etc. 4 Development of long range integrative plans 5 Development of fund-raising strategies Selections of goals and activities by themselves did not affect success. But, selections were critical when analyzed in terms of site conditions (see question 1): 1 <u>Level of use:</u> * If the level of use was low, goals and activities were most successful if the focus was on raising the general level of awareness and interest, rather than implementing concrete, defined practices. * If the level of use was moderate or high, goals and activities were most successful if the focus was on developing management systems and writing long range plans for integrating technology into the curriculum. 2 <u>Readiness to make change</u> (resources and administrative support): * In districts lacking in resources or administrative supports, it was critical to address these factors before going on to other goals and activities. 3 <u>Nature of the local planning team</u> (knowledge and skills in technology and planning): * Goals and activities were most successful when the district was ready and team was oriented to planning, and least successful when there was no district readiness or interest in planning.
3 The impact of the assistance provider's (liaison's) individual style, expertise, or approach on project outcomes	The assistance provider's style and expertise had no particular effect on success. All seemed to have core set of skills (listed in report). Sophisticated technical expertise was less important than expertise in planning for change.

4 The impact of the intensity and duration of technical assistance on project outcomes	Five days of on-site assistance during the school year was generally the maximum amount that an LEA could use effectively. More intense assistance could not compensate for lack of leadership, poor team skills, or low readiness. Most sites could have benefitted from assistance over a longer period of time, particularly sites with low levels of use and low readiness. The development and implementation of a practice often took two full school years. Institutionalization occurred in only a few sites over the course of two years -- sites where technology was already in use, readiness was high, and team skills were well-developed.
Organizational Context The project included some multi-LEA levels of organization--state or regional organizations--to study organizational context.	The following findings applied to regional and state levels: * Liaisons needed to pay particular attention to the organizational structure. * Planning and process issues were more important than at local level. * Regional or state organizations needed to have established infrastructures and working relationships with their constituent districts for the project to be successful. * Assistance worked best when teams focused on regional/state goals (e.g. establishing a regional resource base) rather than local goals. * Two years of assistance was absolutely necessary to develop and disseminate new practices.
Effective Technical Assistance Strategies--organized by outcome: 1 For implementation of new practices	For districts with low levels of use or support, successful strategies promoted knowledge and skill development by the team and expanded support. On-site visits, software review days, "mini-fairs", pilot tests, etc. were effective.

2 For institutionalization of new practices	This required at least a mechanical level of use and a moderate level of support. Assistance with planning, setting up systems, incorporating computers into budgeting process, user groups, etc. were effective strategies.
3 For institutionalization of a process to address issues of special education technology	This required established technology practices, a skilled planning team, and considerable administrative support. Strategies revolved around cultivating administrative support and incorporating technology planning into existing structures.
DISSEMINATION/IMPLEMENTATION STRATEGIES	DISSEMINATION/IMPLEMENTATION OUTCOMES
Dissemination and implementation were addressed in the technical assistance provided during the period of funding. Strategies and outcomes are discussed above. Dissemination beyond this period was not discussed in the documents reviewed.	

(3) The Administrative Applications of Technology	
INSTITUTION	American Speech-Language-Hearing Association
PERIOD OF PERFORMANCE	1988 - 1990
PROJECT DIRECTOR(S) AND PRINCIPAL INVESTIGATOR(S)	James Gelatt and Helen Pollack
FEDERAL PROJECT OFFICER	Jane Hauser
GRANT NUMBER	H180C80012
DOCUMENTS REVIEWED FOR THIS PAPER	Final Report (1990), and <u>Computerizing Administrative Tasks in Schools</u> (1991)
FOR FURTHER INFORMATION	Contact the Sponsored Programs Division of the American Speech-Language-Hearing Association, 10801 Rockville Pike, Rockville, MD 20852. Telephone: (301) 897-5700.
CONTENT AND BACKGROUND	This project studied administrative uses of computers in speech and hearing programs.
RESEARCH METHODS	RESEARCH FINDINGS
<u>Telephone Survey.</u> This survey was conducted to identify administrators of speech and hearing programs who used computers for administration.	The survey found only small number of administrators who used computers for administration.
<u>Mail Survey.</u> This survey was conducted to determine how technology was used, acquired, etc.	The survey results were used to develop a profile of computer users.

<u>Case Studies.</u> Case studies were conducted in 15 sites using interviews, focus groups, document examination, observation, etc. to look for characteristics, trends, strategies, procedures, etc.	The results were used to identify the following elements necessary for successful implementation of computers in administration. 1 Involvement and commitment of top level administration 2 Cooperation with other areas in the school district, particularly those concerned with technology 3 Encouragement of creativity and innovation 4 Knowledge of technology needs so equipment can be made available 5 Provision of access to computers and encouraging (not forcing) their use 6 Support for new technology users from support groups or colleagues 7 Involvement of groups in decision making concerning technology introduction and use 8 Involvement of staff members in planning and implementing specific programs 9 Encouragement of feeling of ownership by aiding in access to programs and providing opportunity to actually manipulate data 10 Introduction of one new thing at a time, not overwhelming staff with too much information 11 Provision of training and later support for computer users
DISSEMINATION/IMPLEMENTATION STRATEGIES	DISSEMINATION/IMPLEMENTATION OUTCOMES
Manual: <u>Computerizing Administrative Tasks in Schools</u> (1991). This manual reflects the findings of the research, and includes additional information.	

(4) Studies of Special Education Administrative Involvement in Computer Implementation	
INSTITUTION	Macro International, Inc.
PERIOD OF PERFORMANCE	1988 - 1991
PROJECT DIRECTOR(S) AND PRINCIPAL INVESTIGATOR(S)	Louise Appell, Carolyn De Meyer Harris and Tom V. Hanley
FEDERAL PROJECT OFFICER	Jane Hauser
GRANT NUMBER	H180C80006
DOCUMENTS REVIEWED FOR THIS PAPER	Final Report-Phase II (1991)
FOR FURTHER INFORMATION	Refer to ERIC Document EC 232 181. Contact Louise Appell at Macro International, Inc., 8630 Fenton Street, Suite 300, Silver Spring, MD 20910. Telephone: (301) 890-5128.
CONTENT AND BACKGROUND	This project studied special education administrator involvement in computer implementation. It was based on a model with the following four domains: administrative, human resources, material resources, instructional applications.
RESEARCH METHODS	RESEARCH FINDINGS
<u>Phase I</u>: A telephone interview survey was conducted with 100 school districts to obtain information on factors influencing the use of computers in special education.	A number of findings were reported about special education administrators involvement in decision making about computer resources. Generally it was found that special education administrators were involved in the purchase of software or hardware, and that they tended to use computers for administrative purposes. There was less evidence of direct interaction between teachers and administrators. Generally, these interactions took place in committee settings. Special education and regular education students frequently used computers together. Training and technical assistance were widely available to teachers.

Correlational analyses were conducted of constructs derived from survey, including teacher and administrator involvement in decision making, availability of training and technical assistance, hardware and software availability, and use of computers with special education students.	Strong correlations were reported between administrator involvement with computer committees and student use of computers. Administrative involvement correlated with the availability of hardware and software. Several other correlations were reported between computer coordinator involvement, teacher involvement, availability of training, and availability of hardware or software.
<u>Phase II</u>: Case studies were conducted in 3 school districts. Data were collected by means of surveys, interviews and observations. The studies were intended to test the hypotheses that: Increased administrative use and/or greater outside experience lead to... Increased administrator involvement in district-level technology planning and decision making, which leads to... Increased availability of hardware and/or software and/or training and technical assistance and/or increased special education technology planning, which lead to... Increased use of computer-based technologies by special education students.	Case studies were presented for the 3 districts, followed by analysis of specific constructs and propositions related to administrative role in technology use. In general, the hypotheses were supported, i.e. it was concluded that special education administrator's involvement in technology planning was correlated with hardware and software use by special education students.
DISSEMINATION/IMPLEMENTATION STRATEGIES	DISSEMINATION/IMPLEMENTATION OUTCOMES
A set of guidelines (below) was developed for special education administrators. Guidelines were based on this project, Macro International's technology integration project (7), and literature. Information was disseminated through SpecialNET, ERIC, conference presentations, etc.	

Guidelines:

- A Define and communicate your interest in technology
- B Identify a model for technology integration
- C Get your office involved
- D Identify an individual to take charge
- E Concentrate your energies
- F Aligning technology applications with your curriculum
- G Be open to experimentation
- H Pilot test good ideas
- I Tap into an enormous network of knowledge
- J Take advantage of available resources
- K Use technology yourself
- L Spend training dollars liberally
- M Use technology to renew teachers' enthusiasm for teaching
- N Address multiple training needs
- O Ensure that the training needs of special education teachers are met
- P Recognize the importance of flexibility in training
- Q Maximize the outcomes of inservice training sessions
- R Be inclusive
- S Follow up after training exercises
- T Assign responsibility to an individual on site
- U Establish a policy for replacing old hardware

(5) Technology Integration Project (elementary level)	
INSTITUTION	Johns Hopkins University
PERIOD OF PERFORMANCE	1986 - 1991
PROJECT DIRECTOR(S) AND PRINCIPAL INVESTIGATOR(S)	Marion V. Panyon and Jeff Hummel
FEDERAL PROJECT OFFICER	Judy Fein
CONTRACT NUMBER	300-86-0125
DOCUMENTS REVIEWED FOR THIS PAPER	Draft of Model (Vol 1, 2 and 3) (1989); <u>Technology Integration Enhancement</u> (manual, 1991); <u>Principal's Assistant</u> (manual, 1989); Final Report for Evaluation of the Integration of Technology for Instructing Handicapped Children-Elementary Level (1991)
FOR FURTHER INFORMATION	Contact the Center for Technology and Human Disabilities, 181 North Bend Road, Baltimore MD 21229. Telephone: (410) 646-3000.
CONTENT AND BACKGROUND	The purpose of this project was to develop and test a model for integrating technology into instruction for handicapped students at the elementary level. <u>3-Dimension Integration Model:</u> The project was based on a model of technology integration with the following three dimensions: (1) <u>Principles</u> (see below); (2) <u>Levels of Organization</u> (see below); and (3) <u>Collaboration</u> (which promotes successful integration of technology) 1 <u>Three "Research-based Technology Integration Principles":</u> 1 Curriculum correspondence 2 Monitored progress 3 Instructional organization 2 <u>Three Levels of Organization:</u> 1 Classroom 2 Building 3 District Based on reviews of literature, goals, objectives and strategies were proposed for each cell of the model.

RESEARCH METHODS	RESEARCH FINDINGS
A series of 12 studies were conducted using descriptive and single-subject designs to focus on topics dispersed throughout the model.	The following are summarized findings across the studies.
	- A Catalog descriptions indicated that there were CAI programs with curriculum correspondence in the market place, but truly accessible CAI with curriculum correspondence was not always available to teachers. - B IEP's were congruent with curriculum but made no mention of CAI. Teachers did not plan CAI use when writing IEP's. - C Computerized IEP's were more specific than hand-written IEP's. - D Students often did better when the teacher introduced CAI and linked it to other resource room instruction. This effect appeared to be influenced by student age and degree of skill proficiency. This finding suggested that teachers should not rely on software, even "tutorial software", to teach students. - E Students might not know about or use software features fully or effectively unless the teacher provided instruction and support. - F The teacher must be actively involved in CAI planning and implementation. - G Training in the use of teacher-modifiable software increased the use of CAI and increased curriculum correspondence. Supports (such as teacher assistants to enter lesson content) might facilitate this process. - H Teachers tended to plan CAI use in manner similar to other instructional decisions. - I Teachers used a variety of methods to monitor student performance on CAI, including on-line data, observation, and student self-report. - J Teachers typically used computers to practice academic skills.

	K Principals were key decision makers for the building level. Teachers were key decision makers for the classroom level, such as student uses of computers, grouping, software used, etc. L Teachers tended to collaborate regarding software selection, acquisition, and organization of computers.
DISSEMINATION/IMPLEMENTATION STRATEGIES	DISSEMINATION/IMPLEMENTATION OUTCOMES
The following implementation products were developed: * <u>Technology Integration Enhancement</u> (1991) Training package with transparencies, handouts and instructions for presenters. * <u>Principal's Assistant</u> (1989) Guide for principals on using computers. The implementation materials were field tested in 11 schools in 4 LEAs. School personnel served as "Internal Change Facilitators". Six schools in 3 LEAs continued with the second year. Training focused on curriculum correspondence, instructional organization, and monitoring progress. Training was scheduled in 75-minute time slots before, during, or after the instructional day. Concerns Based Adoption measures--Stages of Concern, Levels of Use, Innovation Configurations were collected before and after training. Session evaluations were also collected.	Stages of Concern tended to shift from lower to higher stages. Levels of Use also shifted to higher levels. Innovation Configuration data indicated that teachers were using the elements of the model-curriculum correspondence, organization and monitoring. Monitoring progress was implemented less than other areas. Sessions were evaluated positively. Further dissemination activities were described in the Final Report.

(6) Evaluation of the Integration of Technology for Instructing Handicapped Children (Middle School Level)	
INSTITUTION	Education Development Center
PERIOD OF PERFORMANCE	1986 - 1991
PROJECT DIRECTOR(S) AND PRINCIPAL INVESTIGATOR(S)	Catherine Cobb Morocco and Judith Zorfass
FEDERAL PROJECT OFFICER	Judy Fein
CONTRACT NUMBER	300-86-0127
DOCUMENTS REVIEWED FOR THIS PAPER	Final Report of Phase I (1989); Final Report of Phase II (1991); <u>Make It Happen</u> (manual) (1991)
FOR FURTHER INFORMATION	Refer to ERIC Documents ED 342 159 and ED 342 160 Contact Judith Zorfass at Education Development Center, Inc., 55 Chapel Street, Newton, MA 02160. Telephone: (617) 969-7100, ext. 426.
CONTENT AND BACKGROUND	The purpose of this project was to develop and test a model for integrating technology into instruction for handicapped students at the middle school level. The project began with an open-ended plan for studying technology integration in terms of factors at the organizational level (resources, mechanisms, policies, training, etc.) and at the instructional level (teacher knowledge, practices, etc.). In phase II, the research findings were combined with several new assumptions (e.g. the value of inquiry-based curriculum, etc.) to develop a model for integrating technology into instruction.
RESEARCH METHODS	RESEARCH FINDINGS
An intensive, naturalistic study was conducted in four diverse middle schools in Massachusetts. The project had originally proposed a series of large-scale quantitative studies, but found a level of complexity best studied "holistically".	Sixteen major findings were reported. Abbreviated versions are presented below. The Final Report of Phase I presented these findings and gave illustrative examples.

The goal of the study was to describe the integration process and identify key variables and linkages among them.

In the first year, the project noticed that the integration process was slow. A decision was made to accelerate the process when possible by means of training, providing software, etc.

The organizational level: The focus was on contextual and institutional factors. Research methods included focus groups, interviews, observations, etc.

The instructional level: To identify critical teacher practices, administrative practices, supports, etc. Research methods included observations, interviews, etc.

Cumulative analysis involved writing and validating case studies, identifying cross-site factors, developing and organizing assertions about technology integration, developing conceptual framework.

Teacher knowledge and practice

- 1 ...teachers needed to gradually acquire and/or draw on and integrate knowledge about ...students, technology, curriculum, instruction, and assessment.
- 2 ...it was critical for teachers to be actively involved with students' use of software...
- 3 When teachers engaged with others in ongoing reflection about their instructional use of technology, they were more likely to evaluate their practice and redesign instruction...

Technology resources

- 4 Someone needed to be responsible for ensuring that hardware was kept in good working condition and that technical problems were solved.
- 5 When there was some mechanism for narrowing down choices of software, teachers were more likely to try integrating technology into classes.

Teacher development

- 6 When novice computer users had someone to turn to for knowledge about computers as well as emotional support and reassurance, they were more likely to begin integrating technology.
- 7 Inservice workshops could contribute to teachers' acquisition of knowledge, but were insufficient in helping teachers use the knowledge. Teachers [needed] ongoing school-based support and structures for communication and collaboration.

Communication and collaboration

- 8 When two people worked together collaboratively to try out software, technology use tended to be more successful.
- 9 Regular, ongoing communication between regular and special educators who taught the same students often facilitated technology integration...

	<u>School-based facilitation</u> 10 When decisions about hardware acquisition and allocation focused on curriculum goals and teacher experience and expertise, they were more likely to lead to successful integration than when they focused on issues of equity and access. 11 Once a technology-related decision was made, it was unlikely to be implemented unless someone determined what steps to take and ensured that they were taken. 12 Once a technology-related decision was made, administrators and teachers needed to communicate directly to determine if the decision was working or needed revision. 13 To support teacher development, administrators needed to put structures in place so teachers could communicate and collaborate. 14 When administrators varied expectations according to teachers' needs, interests, and abilities and gave teachers choices..., successful integration was more likely to occur. 15 In order for integration to occur beyond individual classrooms, administrators needed to have a vision of the value and potential of computers; and understand that integration implied instructional and organizational changes. 16 Policies and procedures should promote links between special and regular education...
DISSEMINATION/IMPLEMENTATION STRATEGIES	DISSEMINATION/IMPLEMENTATION OUTCOMES
The model was developed into a manual entitled <u>Make It Happen!</u> which was field tested in four middle schools in Massachusetts, New Hampshire, and New York. Data collection for the field test included interviews, observations, document examination, and structured feedback. Qualitative analysis methods were used on these data.	Schools tended to implement the components of <u>Make It Happen!</u> but with a large amount of variability. Two schools evaluated their implementation as highly successful. The other two felt that they had learned a great deal.

In addition, the Stages of Concern questionnaire (focusing on the inquiry-based curriculum) was administered before, during and after the intervention.

DESCRIPTION OF THE MODEL AS IMPLEMENTED

Make It Happen! represented a change in focus from technology to curriculum. It was a school-based approach for integrating technology in the context of an interdisciplinary, inquiry-based curriculum called "I-search".

A planning team consisting of regular and special education teachers, specialists, and administrators implemented the curriculum.

The guiding principles of the approach are presented in abbreviated form below.

- 1 The approach must respond to the dramatic changes in early adolescence.
- 2 Teachers themselves must engage in an inquiry process.
- 3 The assumption is that active, inquiry learning benefits all students.
- 4 The approach must promote change concurrently at the organizational, curriculum, and instructional levels (see components below).
- 5 The approach must engage representatives from all sectors of the school community--students, teachers, administrators, etc.
- 6 The approach must make ongoing communication and collaboration an essential feature of the innovation.
- 7 The approach must be developmental--tasks required at each phase of innovation

The components of the approach at the organizational and instructional levels are presented below:

Four factors that apparently facilitated implementation were: (1) a strong facilitator, (2) communication and collaboration between teachers, (3) curriculum flexibility, (4) understanding of inquiry-based learning.

FIELD TEST OUTCOMES

Stages of Concern

Across the three administrations, this instrument revealed patterns of decreasing concerns at the stages of awareness, information, and personal; level collaboration concerns; and increasing concerns at the stages of management, consequence, and refocusing.

Student Outcomes:

- * Teachers reported increased student content knowledge.
- * Students displayed use of information search resources and methods.
- * Teachers reported and students displayed positive attitudes about I-search.

Teacher Outcomes:

- * Teachers reported and displayed increased knowledge and skills related to the approach, such as inquiry learning, writing process, word processing, student needs, etc.
- * Teachers displayed the application of knowledge and skills in classroom practice.
- * Teachers displayed communication and collaboration during implementation.
- * Teachers performed new leadership functions related to the model.

Organizational Outcomes:

- * Some changes in roles were observed for teachers and principals.
- * Technical assistance was provided to teachers.
- * Changes in organization structures included changes in schedules to allow planning and student grouping, new teacher teams.
- * Acquisition and allocation of resources included teacher discovery of resources

<u>Organizational Level</u> 1 The principal assumes overall leadership. 2 A strong facilitator guides the process. 3 A site-based management team shares decision-making. 4 An interdisciplinary team of teachers designs the curriculum. <u>Instructional Level</u> 1 An "I-search" approach underlies the instructional process. 2 Several key instructional approaches support the I-search process: * Teacher as facilitator * Active learning * Cooperative learning * Technology as a tool (simulations, databases, word processors, graphics, etc.) * Process writing * Ongoing assessment The process of implementing <u>Make It Happen!</u> was envisioned as beginning in the spring of one academic year and extending through the spring of the next academic year. The following phases were included: (1) Start-up, (2) Curriculum design, (3) Curriculum implementation, (4) Evaluation, and (5) Expansion.	<u>REVISIONS TO THE APPROACH</u> Based on the field test, minor revisions were made to the implementation model and materials. <u>REVISION TO PHASE I FINDINGS</u> Based on the field test, the findings from Phase I were revised to reflect the importance of the curriculum. It was suggested that the integration of technology was not driven by technology, but by developing a strong and effective curriculum. The 16 findings from phase I were revised and expanded to reflect this emphasis on curriculum and the role of technology in the curriculum, and to suggest inquiry-based learning as a means for integrating technology.
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(7) Model for the Integration of Technology for Instructing Handicapped Students (High School Level)	
INSTITUTION	Macro International, Inc.
PERIOD OF PERFORMANCE	1986 - 1991
PROJECT DIRECTOR(S) AND PRINCIPAL INVESTIGATOR(S)	Louise Appell, Michael Livesay and Tom V. Hanley
FEDERAL PROJECT OFFICER	Judy Fein
CONTRACT NUMBER	300-86-0126
DOCUMENTS REVIEWED FOR THIS PAPER	Model for the Integration of Technology for Instructing Handicapped Students (1989); Phase II Implementation and Evaluation of the Model: Evaluation of the Integration of Technology for Instructing Handicapped Students (High School Level) (1989); Final Report: Evaluation of the Integration of Technology for Instructing Handicapped Students (High School Level) (1989); Final Report, Phase II: Evaluation of the Integration of Technology for Instructing Handicapped Students (High School Level) (1991); <u>A Model for Technology Integration</u> (manual, ND)
FOR FURTHER INFORMATION	Contact Louise Appell at Macro International, Inc., 8630 Fenton Street, Suite 300, Silver Spring, MD 20910. Telephone: (301) 890-5128.
CONTENT AND BACKGROUND	The purpose of this project was to develop and test a model for integrating technology into instruction for handicapped students at the high school level. The project was based on a model of technology integration with four organizational domains: (1) administrative, (2) human resources, (3) material resources, and (4) classroom instructional applications. Principal lines of influence in this model flowed from administrative to human and material resources, then to classroom applications. However, secondary lines of influence connected other domains. For example, classroom practices influenced the administrative domain. A research taxonomy was developed to organize research in the literature.

RESEARCH METHODS	RESEARCH FINDINGS
<u>Case Studies</u> Case studies were conducted with a sample of 10 high schools and 29 special education teachers in 2 school districts. Sources of information included interviews, direct observation, document review.	<u>CASE STUDY FINDINGS:</u> 1 <u>Administration</u> * Planning and implementation of instructional applications tended to be highly decentralized (little administrative involvement). * Administrators were highly involved in the purchase of hardware. * Special education teachers had been effective in obtaining computers. * Teachers determined their own patterns of use. * Decentralization resulted in great variability in the type and extent of CAI use. 2 <u>Group Organization</u> * There was a trend from informal "users groups" to established computer committees. * Committees at school and district levels tended to focus on hardware--acquisition, allocation. 3 <u>Hardware Distribution</u> * Hardware was mostly Apple II and IBM clones in computer labs or classrooms. * Management of hardware was often assigned to a teacher. 4 <u>Software Distribution</u> * Of 17 categories of software, 15 were available. * Word processing and CAI in math, reading and language arts were most commonly used. * 87 specific programs were used, but only 13 in three or more settings. * Teachers tended to select software and manage their own software collections.

	5 <u>Special Education Classes</u> * Of 29 special education teachers, 22 made regular use, 7 made little or no use of computers. * The most common uses were student records, CAI, and word processing. * Teachers managed and scheduled computers, often providing them as a reward. * Neither computer-managed instruction nor other techniques to integrate or monitor CAI were evident. * Greatest "unmet needs" reported were for more hardware and for assistance in selecting and acquiring software. 6 <u>Inservice Training and Technical Assistance</u> * Little school-based computer-related inservice training was provided. * Teachers tended to rely on other teachers in their schools for one-to-one technical support. Most often, these were computer coordinators and media specialists. Sometimes, specific teachers were viewed as experts. 7 <u>High School Computer Applications</u> * Besides special education, three departments that most used computers were math, science and business.
<u>Technology Assessment Survey</u> A survey was developed to find discrepancies between actual and desired technology uses. The survey was tried out in year one, refined and used in subsequent years. Survey results were used to provide feedback to the schools.	Ratings of importance were found to differ between teacher groups. For example, special education teachers rated games, behavior management and rewards more important than did teachers generally. Levels of use were also found to differ. For example, special education teachers tended to use drill and practice, tutorial, educational games, behavior management and rewards more than did teachers generally.
<u>Computer Industries Substudy</u> A survey of software and hardware vendors was conducted to obtain their perspective.	Comments were obtained relating to product development, marketing and advertising, partnerships with school districts, and future directions.

<u>Study on the Association Between District Size and Teacher Decisionmaking</u> Data from the National Center for Educational Statistics on average district size for each state was correlated with the Carnegie (1988) survey on teacher decisionmaking.	High negative correlations were found between mean district size and decisionmaking involvement of teachers.
<u>Curricular Studies</u> Studies were conducted to define the curriculum in terms of IEP objectives and instructional experiences. A curriculum taxonomy was developed containing specific curriculum content areas (1,126) in math, language arts, and other areas. A sample of 137 mildly handicapped students were included. Data were collected on background information, course schedules, IEP objectives and participation in CAI. A list of 1909 software products was used.	The average number of IEP objectives was 33. Differences were observed between content areas and school districts. Courses for special education students were not unlike typical schedules for nonhandicapped peers. Computers were used in 13% of course periods, for language arts (68 periods per year), vocational education/IA (33), math (27), and social studies (10). Further analysis was presented on the uses of computers in curriculum for special education and regular education.
<u>Evaluation of Critical Issues for the Model</u> Project staff collected comments and ratings for critical issues.	Ratings were reported.
DISSEMINATION/IMPLEMENTATION STRATEGIES	DISSEMINATION/IMPLEMENTATION OUTCOMES
The model was developed into a manual which was field tested in six high schools in four school districts. Data collection included interviews, technology surveys, observations, telephone monitoring of meetings and activities, document reviews, etc. The technology survey used in Phase I was administered in three schools twice--once early in Phase II and once at the end of Phase II.	Summary descriptions organized by model domains were presented for the districts and schools. <u>FINAL PRODUCT</u> Following the field test, a revised version of the manual was prepared. Entitled <u>A Model for Technology Integration</u>, this manual had sections on instructional, administrative, human resources, and material resources domains. Targeted at administrators, the manual was designed for usability.

DESCRIPTION OF THE MODEL AS IMPLEMENTED

The manual included information on the following integration activities.

Integration Activities in the Administrative Domain

- Information gathering--survey users, needs analysis
- Establishing technology plan
- Cooperative planning
- Collaboration
- Technology Committees--district and school level
- Leadership

Integration Activities in the Human Resources Domain (staff development)

- Identify competencies
- Levels of training (basic, intermediate, advanced)
- Training methods, incentives
- Establishing and defining roles--computer coordinator, technician, media specialist

Managing Material Resources for Technology Integration

- Defining purposes
- Designing installations
- Installing and introducing
- Operating and supporting
- Evaluating suitability
- Issues of equity, placement

Classroom Instructional Applications

- Organizing to enable computer applications
- Planning and implementing classroom instructional applications

(8) Making Administrative Decisions about Technology by Examining Promising Instructional Practices	
INSTITUTION	Macro International, Inc.
PERIOD OF PERFORMANCE	1990 - 1992
PROJECT DIRECTOR(S) AND PRINCIPAL INVESTIGATOR(S)	Louise Appell and Elaine Robey
FEDERAL PROJECT OFFICER	Jane Hauser
CONTRACT NUMBER	HS90009001
DOCUMENTS REVIEWED FOR THIS PAPER	Technical Proposal (1990); Deliverable #7 Case Study Reports from Site Visits (1991); Deliverable #8 Case Study Reports from Site Visits (1991); List of Themes from Case Studies (working document)
FOR FURTHER INFORMATION	Contact Louise Appell at Macro International, Inc., 8630 Fenton Street, Suite 300, Silver Spring, MD 20910. Telephone: (301) 890-5128.
CONTENT AND BACKGROUND	The basic intent of this project was to identify promising practices in technology and use these as a vehicle for informing administrators about effective uses of instructional technology. Efforts were based on Macro's four-domain model of technology integration: administrative, human resources, material resources, classroom instructional applications.
RESEARCH METHODS	RESEARCH FINDINGS
Information was gathered from literature and expert opinion.	Themes from the case studies were reported in a working document. Condensed versions of these themes are presented below:
Case studies were conducted of promising technology practices.	I <u>ADMINISTRATIVE DOMAIN</u> A <u>Role of Administrators</u>. Administrators are critical to the successful implementation of technology in an educational setting. Administrators at all levels should be involved in decisions about technology.

	1 Superintendents play a key role in technology implementation through assignment of staff and long-range planning for technology... 2 The superintendent needs to be supportive of new instructional use of technology but leadership can also come from the special education director, the building principal, or other central office staff. 3 Administrators have an important role in communicating the district's or school's vision and providing tangible support for its realization... 4 At the administrative level a positive attitude about experimentation and giving staff the freedom to fail are important for expanding technology use... 5 If administrators have an outcome orientation this will make the needed changes in rules and standard procedures easier to recognize and implement. 6 One contribution that administrators often make to technology use and dissemination is in the careful selection ("handpicking") of staff for key roles. 7 Administrators can foster communication between special education and regular education on technology issues... 8 When community involvement is important in the process of technology implementation ...administrators have an important contribution to make in formulating that presentation appropriately. Successful implementers have worked very hard at communicating with the broader school community.
	B <u>Creating a Philosophy.</u> A mission statement or statement of educational philosophy can unify the staff in all their efforts. In practice the philosophy of meeting children's needs can translate into teachers introducing a variety of practices that incorporate technology in order to respond to the differences in children's needs and learning styles.

	1 Decisions to implement technology are usually based on a specific instructional need that was discerned. Specific strategies are then developed that are consistent with the system's overall philosophy. 2 Good leaders within the school system know where they want to go; they have a vision that they are able to express. 3 Staffs in districts with promising practices of technology use were able to articulate a shared philosophy. They fully endorse their district's overall philosophy... 4 A consistent approach of administrators where there is effective use of technology is to focus on the overall aim: set the goal or the direction but not the specific means for reaching it... 5 Planners need to have a future orientation, a recognition that education is more than the 3 Rs...
	C <u>Creating a Setting.</u> The climate for the implementation of technology into instruction is critical to the ease of its introduction and its ultimate success. 1 The administrators and staff that are involved in the introduction of technology to a district need to have a receptivity to new ideas. 2 Effective implementers have a broad knowledge base and draw together bits and pieces from diverse sources to develop and refine practices. Use of research based information helps inform the planners and implementers. 3 Incremental introduction of technology has a number of advantages... 4 The leaders of technology development are given the freedom to experiment, to create... 5 Implementation of technology is aided by a problem solving orientation to the process of teaching: a need is identified, teachers provide insight into a possible solution. 6 People at all levels of the organization need to work together cooperatively...

	7 Cooperation among people at different levels is more prominent in the early stages of planning for technology use... 8 Reinforcement of group process efforts (for example, participation in committees that give direction) is important to successful implementation... 9 The school board needs to be informed and supportive of the integration of technology into the school system. 10 Differences in organizational characteristics of school system (whether centralized or site-based management) should be addressed, but technology can be implemented in either a traditional or restructured environment. 11 Technology allows for curricular change. Technology is an important tool in restructuring.
	D <u>Communication</u>. Good communication is critical to the initiation and dissemination of technology use in instruction. Good practices appear to be linked to a high level of communication among the staff. 1 Communication of a shared philosophy (and shared responsibility in the decision-making) allow for the development of shared priorities. 2 Committees to focus on technology and its implementation in instruction often work best when composed people who share such interests and are not necessarily related to their formal job titles or roles. 3 Communication is often informal and nonhierarchical. 4 A cadre of involved teachers can share their knowledge and enthusiasm about good or innovative practices and promote their use by other staff... 5 Cross-departmental collaboration is important for some applications of technology... 6 Fostering opportunities for networking will allow individuals in many roles and locations to share information.

	E <u>Planning for Technology.</u> Implementing technology into the instruction in a school or district should consider all the resources that are needed and should consider the timing of all these elements. 1 Resources don't just mean equipment. It is necessary to provide the required infrastructure to support technology use (e.g. wiring in a building, phone lines). 2 Timing is critical. There is a need to plan for training, technical assistance, software, and other materials so that they are available at the same time the equipment is introduced... 3 Careful attention in the planning stage must focus on who will assume responsibility for technical assistance and training and how it will be offered. 4 Staff development must be planned and budgeting for...
	F <u>Obtaining Funding.</u> Funding is always a concern of districts wanting to implement technology into their curriculum, but the successful programs have not let this issue be an obstacle. 1 If a positive attitude about the acquisition of resources is maintained and the administrators are persistent, a district can tap additional funds. 2 Sometimes resources can be developed by redistributing spending patterns within the current budget. 3 Successful districts have been creative in identifying internal and external funding. 4 Community-based support can be accessed to increase the funds available or to receive services or equipment... 5 Careful planning and research can make the district's money go further when making expenditures for technology.
	II <u>MATERIAL RESOURCES</u> A <u>Capabilities of the Technology.</u> Specific hardware and software purchases become less of a focus if the first consideration is the instructional need to be met.

	1 Practices are often relatively platform independent. Districts need to recognize this and not get caught up in the glitz, purchasing the latest or most heavily marketed equipment... 2 Technical obsolescence is inevitable. Technically obsolete equipment may be adequate for meeting the original (or other) educational needs... 3 The level of technology (high vs. low) is not a predictor of its potential educational effectiveness...
	B <u>Efficient Equipment Use</u>. There are numerous mechanisms to make efficient use of equipment required for the introduction of technology into the curriculum. 1 If the process begins by identifying needs, then it is possible to establish those which can be met by use of older equipment. 2 The use of hardware and software can be monitored and reallocated to other programs and teachers if they are not being used... 3 Equipment can be shared. It is not necessary to retain equipment for a single purpose. 4 Using equity as a means of allocating material resources does not always produce the most efficient use of technology. An alternate approach is to create a critical mass of equipment around interested staff... 5 Selecting the right person to assist in making decisions about hardware and software acquisition enables better choices to be made. 6 Technology specialists can aid in maximizing the application of material resources, particularly in keeping equipment running or adapting in-house materials to perform required functions.
	III <u>HUMAN RESOURCES</u> A <u>Staff Roles</u>. Human resources are critical to successful implementation and continued use of a practice.

	1 Roles need to be restructured so that human resources are available to support technology use... 2 Cross-fertilization among technology users is important... 3 Positions need to be developed to support the integration of technology into the curriculum... 4 For teachers to become active users of technology and begin to think of uses to incorporate into their classrooms, it is a good idea to introduce more generic applications first...
	B <u>Technology Coordinator Position</u>. Creation of a technology coordinator/specialist role is extremely important to successful implementation of technology in a school or district. 1 Centralization of technical knowledge is necessary in the early stages of implementation... 2 There is a need for on-site troubleshooting support; it is a subset of technical assistance... 3 Technology coordinators need to be generalists and to provide a teacher perspective in delivering technical assistance and other support. 4 The individual chosen for the technology coordinator role should have enough latitude to respond to requests, exercise creativity, and be available for problem situations. 5 A key technology person for special education can access additional resources needed to meet the needs of specific students...
	C <u>Technical Assistance</u>. Technical assistance must be readily accessible if technology is to be successfully implemented into a school or a district. 1 A good deal of staff development takes place in the offering of on-the-spot (in the classroom) technical assistance.

	2 The staff needs to feel that technical assistance is readily available to them... 3 The background and personality of the person providing the technical assistance is essential to his/her effectiveness...
	D <u>Training</u>. A carefully designed program for staff development is an essential component in the planning and implementation of technology use in the classroom. 1 Inservice training is valuable to the extent that is appropriate to teachers' needs and interests... 2 Staff will be willing to participate in useful training without compensation... 3 Successful inservice training can be conducted by in-house personnel who understand the philosophy, goals, and instructional context of the participating staff. 4 Buying outside expertise should lead to increased in-house expertise... 5 Using teachers to model teaching with technology is an important part of staff development.
	IV <u>CLASSROOM APPLICATIONS</u> A <u>Teachers</u>. Successful implementation of technology into the curriculum is based on maximizing teachers' effectiveness in developing instructional uses, applying them to the classroom, and disseminating relevant experiences to others. 1 It is more important to get technology into the hands of teachers so they can integrate it into their activities and the curriculum rather than to give it immediately to students... 2 The most effective teachers for incorporating technology were those who had receptivity to new ideas and possibilities to help educate children, and who were employing many ideas to improve instruction.

	3 Working with technology often promotes teacher renewal... 4 Those involved in technology implementation never seem to feel that they are all done... 5 Enthusiastic staff, who get positive reinforcement from supervisors, are often willing to assume responsibility and spend more time to support technology use... 6 Teachers who are actively experimenting and implementing technology need to know that their opinions, experiences, and expertise are valued.
	B <u>The Classroom</u>. The use of technology in regular and special education classes has a profound impact on the on the classroom and the way learning takes place. 1 When technology is effectively incorporated into instruction it is often because the technology was not seen as "the answer;" it is viewed as a tool. 2 Students and teachers are learning together as a natural consequence of technology use, and this changes the role of the teacher in the classroom. 3 Students become more active and enthusiastic learners in the classroom. 4 Some of the best technology applications in the classroom allow for variations in teaching styles, differences in students... 5 Focusing on practices for the classroom and overall objectives can promote receptivity to use of various forms of technology... 6 Technology can assist in fuller inclusion of students with disabilities in mainstream programs. 7 Use of new media and technologies in instruction can help students with learning differences to succeed... 8 Technology is recognized as a tool for one's lifetime...
DISSEMINATION/IMPLEMENTATION STRATEGIES	DISSEMINATION/IMPLEMENTATION OUTCOMES
A number of dissemination activities included the use of videotape and teleconference technologies.	